

P116301 EP-HH

# EUROPEAN PATENT OFFICE

**Patent Abstracts of Japan**

PUBLICATION NUMBER : 11232602  
 PUBLICATION DATE : 27-08-99

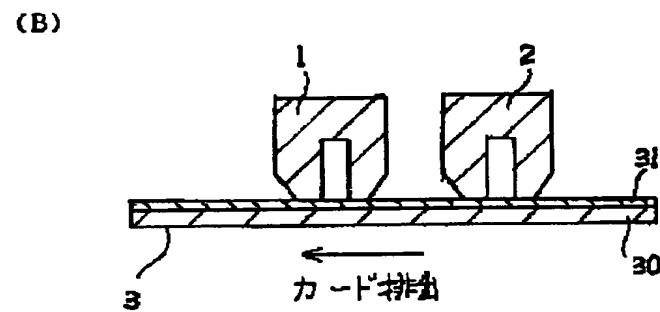
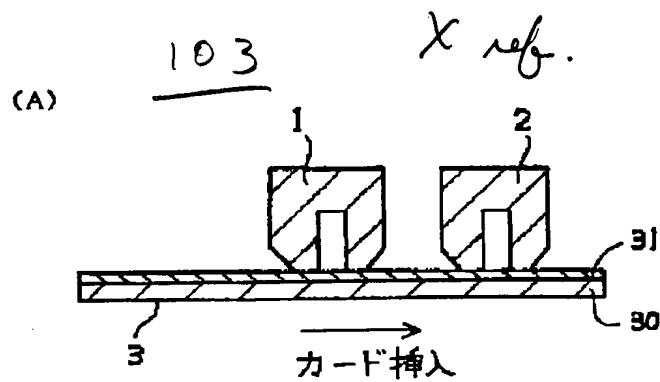
APPLICATION DATE : 18-02-98  
 APPLICATION NUMBER : 10036458

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INT.CL. : G11B 5/02 G11B 5/09 G11B 5/706  
 G11B 5/80

TITLE : MAGNETIC RECORD MEDIUM AND  
 REPRODUCTION METHOD THEREOF



**ABSTRACT :** PROBLEM TO BE SOLVED: To prevent a fraudulent use of data of a magnetic record medium, which has MnBi magnetic powders in a magnetic layer, caused by copying the data of this magnetic record medium onto the magnetic recording medium in which usual magnetic powders are used as recording elements.

SOLUTION: In a magnetic record medium such as a magnetic card 3 provided on a substrate 30 with a magnetic layer 31 having MnBi magnetic powders, a special signal for performing a degaussing operation of a portion at which a data signal is recorded and a conversion operation for converting the data signal into a meaningful data is recorded together with the data signal. At reproduction, the special signal is first read out, and the data signal is then converted into the meaningful data by the special signal by using a residual output after the degaussing operation.

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# PATENT ABSTRACTS OF JAPAN

(11)Publication number : **11-232602**  
 (43)Date of publication of application : **27.08.1999**

(51)Int.CI.

**G11B 5/02**  
**G11B 5/09**  
**G11B 5/706**  
**G11B 5/80**

(21)Application number : **10-036458**  
 (22)Date of filing : **18.02.1998**

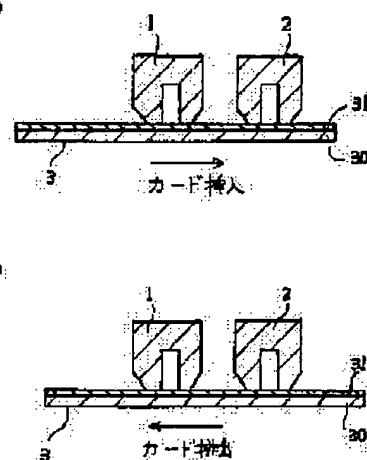
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## (54) MAGNETIC RECORD MEDIUM AND REPRODUCTION METHOD THEREOF

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To prevent a fraudulent use of data of a magnetic record medium, which has MnBi magnetic powders in a magnetic layer, caused by copying the data of this magnetic record medium onto the magnetic recording medium in which usual magnetic powders are used as recording elements.

**SOLUTION:** In a magnetic record medium such as a magnetic card 3 provided on a substrate 30 with a magnetic layer 31 having MnBi magnetic powders, a special signal for performing a degaussing operation of a portion at which a data signal is recorded and a conversion operation for converting the data signal into a meaningful data is recorded together with the data signal. At reproduction, the special signal is first read out, and the data signal is then converted into the meaningful data by the special signal by using a residual output after the degaussing operation.



### LEGAL STATUS

- [Date of request for examination]
- [Date of sending the examiner's decision of rejection]
- [Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
- [Date of final disposal for application]
- [Patent number]
- [Date of registration]
- [Number of appeal against examiner's decision of rejection]
- [Date of requesting appeal against examiner's decision of rejection]
- [Date of extinction of right]

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CLAIMS

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[Claim(s)]

[Claim 1] The magnetic-recording medium characterized by recording the accident warning signal for performing demagnetization processing of the portion which recorded the data signal with the data signal in the magnetic-recording medium containing MnBi magnetism powder into the magnetic layer, and transform processing which changes a data signal into capable data.

[Claim 2] The magnetic-recording medium according to claim 1 by which the data signal and the accident warning signal are recorded on the same track.

[Claim 3] The magnetic-recording medium according to claim 1 currently recorded on the truck with which a data signal differs from an accident warning signal.

[Claim 4] The magnetic-recording medium according to claim 1 to 3 which the magnetic layer was prepared in one side or both sides of a substrate, and was made into the card-like gestalt.

[Claim 5] a magnetic layer -- the whole surface of a substrate -- or -- being partial (the shape of a stripe being included) -- the magnetic-recording medium according to claim 4 formed

[Claim 6] The reproduction method of the magnetic-recording medium which performs demagnetization processing of the portion which read the accident warning signal and recorded \*\*\*\*\* and the data signal first in the reproduction method of a magnetic-recording medium according to claim 1 to 5, and is characterized by therefore changing a data signal into an accident warning signal by the after heat power after demagnetization processing subsequently to capable data.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to a magnetic-recording medium and its reproduction methods, such as a magnetic card which contains MnBi magnetism powder in a magnetic layer.

[0002]

[Description of the Prior Art] Since record reproduction is easy for a magnetic-recording medium, it has spread widely as videotape, a floppy disk, a credit card, a prepaid card, etc. However, incorrect intermediary elimination of the recorded data is easy to be carried out conversely, and the problem that the alteration of data can also be performed easily has the feature that record reproduction is easy. for example, intermediary \*\*\*\* [ as ] used for our familiar places, such as various doors and a handbag, in a magnetic card recently -- it is eliminated with the magnet of a strong magnetic field, or the accident and the crimes of data being rewritten and used improperly of a magnetic card are occurring frequently

[0003] The record medium whose rewriting will be impossible once it makes a laser beam cause an irreversible change and therefore records on a record medium like an optical card as this cure at it, for example, and the alteration of data are difficult, and the high IC card of security nature etc. is proposed. However, it has not spread, so that the expensive equipment only for optical cards which records an optical card and is reproduced is newly needed, and there is a difficulty of becoming quantity cost in order to use a semiconductor in an IC card, it does not come to substitute an optical card with record of the magnetic card with which all have spread all over the world, and a regenerative apparatus and it is still expected.

[0004] Therefore, giving printing which the policy which prevents the alteration of a magnetic card was proposed variously, for example, made full use of hologram printing or advanced printing technology to the magnetic card is performed. However, although effect can be demonstrated in that the forgery on the appearance of a card is prevented, these methods are read from others' credit card on the regular credit card which the alteration received with the unjust means, for example, and when carried out by writing in \*\*\*\*\* data etc., since the written-in data are regular, they cannot prevent this.

[0005] On the other hand, once the magnetic-recording medium which used MnBi magnetism powder as a record element records a signal, it is known for the room temperature in each official report, such as JP,52-46801,B, 54-19244, 54-33725, 57-38962, 57-38963, and 59-31764, that there is the feature of not being easily eliminable. Incorrect intermediary elimination of the data is carried out, or it is observed as what can prevent the accident and unauthorized use today when the reader for magnetic cards has spread to all the corners in the world especially in a credit card, a money card, etc. with which accident and crimes, such as being rewritten intentionally, are occurring frequently.

[0006]

[Problem(s) to be Solved by the Invention] Thus, the magnetic-recording medium which used MnBi magnetism powder as a record element demonstrates powerful security for the use which a credit card, whose money card, etc. are only reproduction and does not have the need of rewriting if a signal is recorded once. However, although rewriting of this medium is difficult, it is possible to copy to the magnetic-recording medium which read the data of this medium and used the usual magnetic powder as a record element.

[0007] A card is mentioned as an example and explained. Since a design etc. differs from the thing of a regular card when the data of the card which used MnBi magnetism powder are copied to the card which used the usual magnetic powder, in using it in public like a credit card, it discovers that it is a copy card. It can distinguish easily that they are the thing which made full use of advanced printing technology, such as a hologram, for the design of the card which used MnBi magnetism powder especially, then a copy card. However, by having copied data, since there is no function to discriminate a design in ATM like ATM (a cash automatic deposit and expenditure machine) in using a card in an uninhabited place, \*\*\*\*\* will also be processed as a regular card, if data are regular.

[0008] this invention aims at preventing the unauthorized use by being copied to the magnetic-recording medium which used the usual magnetic powder with which the data of this magnetic-recording medium do not contain MnBi magnetism powder as a record element in the magnetic-recording medium which contains MnBi magnetism powder in a magnetic layer in the light of such a situation.

[0009]

[Means for Solving the Problem] This invention persons found out that the data of this magnetic-recording medium could prevent being copied to other magnetic-recording media well by recording the accident warning signal for performing demagnetization

processing of the portion which recorded the data signal on the magnetic-recording medium which contains MnBi magnetism powder in a magnetic layer with the data signal, and transform processing which changes a data signal into capable data, as a result of inquiring wholeheartedly to the above-mentioned purpose.

[0010] If a magnetic card is taken for an example, after cooling and demagnetizing a card at low temperature (initialization), the above-mentioned accident warning signal is recorded with a data signal. On the occasion of reproduction, a card is inserted in a read head, a signal record portion is read, separation extraction of the accident warning signal is carried out, and demagnetization processing of the signal record portion is carried out with the directions. Since the card with which a line intermediary also contains MnBi magnetism powder has the very large coercive force of the above-mentioned magnetic powder, although a signal is not eliminated in this processing, a signal will be eliminated by the above-mentioned demagnetization processing in what copied data to the card using the usual magnetic powder. Next, with the card containing MnBi magnetism powder, a read head performs re-reading of a signal record portion, a data signal is extracted, and this is changed into capable data by the accident warning signal.

[0011] Thus, in what copied data to the card using the usual magnetic powder, since all record signals will be eliminated by demagnetization processing, a copy card can be eliminated. Moreover, a data signal and an accident warning signal are separated by a certain method, and though only a data signal is able to be copied without recording an accident warning signal including a demagnetization processing signal, since this data signal is enciphered, unless it uses an accident warning signal, it is not convertible for capable data. In short, MnBi magnetism powder is made to contain this in a magnetic layer, and copy prevention to the card which used the usual magnetic powder can be effectively realized by recording the accident warning signal for performing demagnetization processing of a signal record portion, and transform processing to the capable data of a data signal simultaneously with a data signal.

[0012] This invention is completed based on the above-mentioned knowledge. In the magnetic-recording medium which contains MnBi magnetism powder in a magnetic layer namely, with a data signal In the reproduction method of the magnetic-recording medium (claims 1-5) characterized by recording the accident warning signal for performing demagnetization processing of the portion which recorded the data signal, and transform processing which changes a data signal into capable data, and this magnetic-recording medium First, demagnetization processing of the portion which read the accident warning signal and recorded \*\*\*\*\* and the data signal is performed, and the reproduction method (claim 6) of the magnetic-recording medium subsequently to capable data characterized by therefore changing a data signal into an accident warning signal by the after heat power after demagnetization processing is started.

[0013]

[Embodiments of the Invention] At a room temperature, the MnBi magnetism powder used for this invention will fall, if temperature falls, although coercive force is as high as about 10,000 Oes, and it is set to 1,500 or less Oes by 100K. It can demagnetize by cooling at low temperature using this property, and after demagnetization can be easily magnetized at a room temperature. Drawing 1 is the initial magnetization curve of a magnetic-recording medium (longitudinal direction magnetic layer) which used MnBi magnetism powder. When it cools at low temperature and changes into a demagnetization state from this, it turns out that it is easily magnetizable at a room temperature with the low magnetic field of about 2,000 Oes.

[0014] Moreover, once it magnetizes this magnetic-recording medium, the high coercive force of about 14,000 Oes will be shown, and elimination and rewriting of subsequent data will become almost impossible. Drawing 2 shows the elimination property of the magnetic card (the after-mentioned example 1) which used MnBi magnetism powder, and the magnetic card coercive force ] (the after-mentioned example 1 of comparison) using the barium-ferrite magnetism powder of 2,750Oe(s). Both cards are recorded on the same conditions in the same reader writer. As for the magnetic card (curvilinear-2b) using barium-ferrite magnetism powder, even the current value of about 300mA is understood that loss of power is very small to a reproduction output serving as zero mostly by the current value of about 100mA for coercive force with the big magnetic card (curvilinear-2a) using MnBi magnetism powder.

[0015] The MnBi magnetism powder which has such a feature obtains a MnBi ingot by powder-metallurgy processing, the arc furnace solution process, the RF solution process, the melt extraction, etc., grinds this and is manufactured. For example, when manufacturing with powder-metallurgy processing, it divides into the production process, trituration process, and stabilizing treatment process of an ingot, and is manufactured as follows. In addition, MnBi magnetism powder can also be manufactured by meanses other than a grinding method.

[0016] At the production process of an ingot, Mn powder of 50-300 meshes and Bi powder are fully mixed, and an ingot is produced for this as a molding object with a pressurization press. Although it is desirable to perform mixture in an inert atmosphere, you may mix in an oxidizing atmosphere. the mixing ratio of Mn powder and Bi powder -- it is showing a good rate to consider as the range of 45:55 to 65:35 by the mole ratio (Mn/Bi) Since the corrosion resistance of MnBi magnetism powder can be improved and good magnetic powder will be obtained by forming the oxide and hydroxide of Mn in the front face when it considers as MnBi magnetism powder if Mn is made [ many ] compared with Bi, it is desirable.

[0017] Although what has the few content of an impurity is desirable as for Mn powder and Bi powder which are used here, in order to adjust magnetic properties, it is what added metals, such as nickel, aluminum, Cu, Pt, Zn, and Fe, and \*\*\*\*\* is also good. When adding such a metal, since magnetic properties are controllable good if it carries out to more than 0.6 atom % to MnBi, the crystal structure of MnBi itself can be maintained good if it is made fewer than 5.0 atom %, and the property of MnBi original can be demonstrated, as for the addition, it is desirable to consider as within the limits of 0.6 - 5.0 atom %. Moreover, as the addition method of these metals, intermediary \*\*'s which attaches the alloy of Mn and these elements beforehand is desirable.

[0018] What was ground beforehand may be used for Mn powder and Bi powder, pulverization of the lumps, such as flakes and a shot, may be ground and carried out, and they may be used for them. Since a generation reaction will progress smoothly and a reaction will be greatly influenced by front-face nature if Mn powder and Bi powder use what carried out pulverization to 50-300 meshes in order that MnBi may generate by the diffusion reaction which lets the contact interface of MnBi pass, when compounding at a sintering reaction, it is desirable in performing surface treatment currently performed with powder-metallurgy processing, such as \*\*\*\*\*ing or degreasing Mn powder and Bi powder front face with a solvent. Mixture of these Mn powder and Bi powder is performed with arbitrary meanses, such as an automatic mortar and a ball mill.

[0019] In case Mn powder and Bi powder are used as a molding object with a pressurization press, as for welding pressure, it is desirable to carry out [ cm ] in 1-8t /. By carrying out welding pressure in 1t/cm or more, a sintering reaction can be promoted, a uniform ingot can be produced and productivity can be improved by considering as 8 or less t/cm. Thus, the molding object acquired is sealed in a glassware or a metal vessel, the inside of a container is made into a vacuum or inert gas atmosphere, and the oxidization under heat treatment is prevented. As inert gas, although hydrogen, nitrogen, an argon, etc. can be used, nitrogen gas is used as optimal thing from the point of cost.

[0020] Thus, subsequently to an electric furnace, the container which sealed the molding object is put in and heat-treated for two - 15 days at 260-271 degrees C. If heat treatment temperature is made into 260 degrees C or more, it can heat-treat in a short time, and the amount of magnetization of an ingot can be made high. Moreover, if heat treatment temperature is made into 271 degrees C or less, since dissolution of Bi can be suppressed and a uniform ingot will be obtained, it is desirable to carry out directly under [ melting point ] Bi.

[0021] At a trituration process, the MnBi ingot produced by doing in this way is taken out, coarse grinding is carried out in inert gas atmosphere with an automatic mortar etc., and it adjusts to 100-500-micrometer grain size. Subsequently, it atomizes by the shock according to the collision of the particle to the wall of between particles or a container by dry grinding, such as wet grinding using the shock of the ball using the ball mill, the planet ball mill, etc., or a jet mill.

[0022] In wet grinding using the shock of a ball, if the path of a ball is gradually made small and is ground as trituration progresses, the more uniform magnetic powder of a particle diameter will be obtained. Since MnBi has hexagonal structure, it does not need to show the property which carries out a cleavage from the first, and does not need to grind, applying energy high for this reason. In the case of wet grinding, it is desirable to use an organic solvent as a liquid. especially -- nonpolar [ , such as toluene, ] -- business -- it is desirable to remove the dissolved moisture in a solvent beforehand using a solvent In dry grinding, it is desirable to carry out by the non-oxidizing atmosphere. As a non-oxidizing atmosphere, it is used as what has suitable inert gas atmosphere, such as a vacuum or nitrogen gas, and argon gas.

[0023] Thus, the MnBi magnetism powder obtained can control a particle diameter arbitrarily according to trituration conditions. It is desirable that it is generally in the range whose mean particle diameter is 0.1-20 micrometers. If [ if a mean particle diameter is set to 0.1 micrometers or more, can make the saturation magnetization of MnBi magnetism powder high, and ] 20 micrometers or less, the surface smooth nature of the magnetic layer when being able to enlarge coercive force of MnBi magnetism powder enough, and considering as a magnetic-recording medium will become good, and a desirable result will be obtained on a recording characteristic.

[0024] At a stabilizing treatment process, the chemical stability of the MnBi magnetism powder obtained by doing in this way is raised, using Mn or Bi which this powder itself has on the front face of MnBi magnetism powder, coats, such as an oxide of these metals, a hydroxide, a nitride, and carbide, are formed, or the same coat as the above is formed using Mn or Bi different from the above-mentioned powder, and chemical stabilization of the above-mentioned powder is achieved.

[0025] It explains about the method of forming the coat of the oxide of Mn and Bi in the front face of MnBi magnetism powder as an example of coat formation of the above-mentioned former using oxygen. First, MnBi magnetism powder is heated at the temperature of 20-150 degrees C among the nitrogen gas containing about 100-10,000 ppm oxygen, or argon gas. Heating time should just lengthen heating time, so that about 0.5 - 40 hours is suitable and temperature is low. The coat of the oxide of Mn and Bi is formed in the front face of MnBi magnetism powder of such processing, and the oxide of Mn most contributed to especially chemical stability is formed preferentially.

[0026] The MnBi magnetism powder used for this invention is obtained as mentioned above, and the coercive force which impressed and measured the magnetic field of 16kOe as magnetic properties is in the range of 3,000-20,000Oe in 300K, and it is in the range of 50-1,000Oe in 80K, and the amount of saturation magnetization which impressed and measured the magnetic field of 16kOe(s) in 300K to the pan is in the range at 20 - 60 emu/g.

[0027] Although the magnetic-recording medium of this invention is characterized by containing the above-mentioned MnBi magnetism powder in a magnetic layer, it may use together magnetic powder usually used for the magnetic-recording medium, such as gamma-acid-ized ferromagnetism powder, cobalt content iron-oxide magnetism powder, barium-ferrite magnetism powder, strontium-ferrite magnetism powder, metal magnetism powder, alloy magnetism powder, and compound magnetism powder, with this MnBi magnetism powder. The operation of magnetic powder besides these may carry out the laminating of the magnetic layer which may be made to contain with MnBi magnetism powder in a magnetic layer, and contains MnBi magnetism powder, and magnetic powder besides these, respectively. Moreover, magnetic powder may not be used but nonmagnetic powder, such as an alpha hematite, and an alumina, a silica, may be used with MnBi magnetism powder.

[0028] It is desirable to make it to about 70% or less by the weight ratio to MnBi magnetism powder as an addition of powder besides these other than MnBi magnetism powder. If the addition of powder besides these is made 70% or less, the signal according the aforementioned demagnetization processing to the after heat power from MnBi magnetism powder is reproducible

with sufficient reliability also after \*\*\*\*\*.

[0029] The magnetic-recording medium of this invention is producible according to a conventional method. First, mixed distribution of the above-mentioned MnBi magnetism powder or the above-mentioned MnBi magnetism powder, and other powder is carried out with a binder resin, the organic solvent, etc., and a magnetic paint is prepared. Next, this magnetic paint is applied on bases, such as polyester film, magnetic field orientation is usually performed by the magnetic field strength of about 1,000-5,000 Oes in parallel with an application side, and it dries after that, and is produced by forming the magnetic layer whose thickness is usually about 4-20 micrometers.

[0030] Moreover, what is necessary is to imprint the magnetic layer formed on this considering the above-mentioned base as a detachability thing on substrates, such as a product made of vinyl chloride resin, and just to consider as the form of the shape of a card which comes to prepare a magnetic layer in one side or both sides of the above-mentioned substrate in magnetic cards, such as a credit card and a money card. In that case, the magnetic layer may be prepared all over the substrate and may be prepared partially [the shape of a stripe etc.].

[0031] Each thing currently generally used to a magnetic-recording medium as a binder resin used for manufacture of a magnetic paint is usable. For example, a vinyl chloride-vinyl acetate system copolymer, polyvinyl butyral resin, a fibrin system resin, a fluorine system resin, a polyurethane system resin, an isocyanate compound, a radiation-curing type resin, etc. are used. In order to raise the chemical stability of MnBi magnetism powder, as for these binder resins, it is desirable to have basic functional groups, such as an imine, an amine, an amide, thiourea, CHIOZO-RU, an ammonium salt, and a phosphonium machine, in a molecule. Moreover, in order to raise the chemical stability of MnBi magnetism powder further, you may make it add the proper additive which has the same basic functional group as the above in a magnetic layer.

[0032] In production of such a magnetic-recording medium, it may be made to form the shield layer containing permalloy powder or Sendust powder in the front face of the magnetic layer containing MnBi magnetism powder, and thereby, reading of data and rewriting become difficulty further and can improve security nature further. Moreover, it is desirable to form concealment layers, such as various kinds of protective layers and a color layer, in the front face of a magnetic layer in the aforementioned magnetic card.

[0033] Thus, when the magnetic-recording medium of this invention produced impressed and measures the magnetic field of 16kOe(s) in the temperature of 300K as magnetic properties, square shape Br/Bm goes into the range whose flux density coercive force is 500-3,000G at the range of 300-20,000Oe at the range of 0.60-0.98.

[0034] The record reproduction method of the magnetic-recording medium of this invention is explained. Special operation is not needed for record of a signal. What is necessary is just to record by the method same in base as the usual magnetic-recording medium using the usual writer. That is, first, after cooling and demagnetizing the magnetic-recording medium of this invention at low temperature (initialization), the accident warning signal for performing demagnetization processing of the portion which recorded the data signal with the data signal, and transform processing which changes a data signal into capable data is recorded.

[0035] Especially the record position of an accident warning signal is not limited. You may record on the same truck as a data signal, and may record on a different truck from a data signal. For example, in a magnetic card, you may record collectively between the data signals before a data signal to the run direction of a card, and separation reproduction of a data signal and an accident warning signal becomes easy in this case. You may make it distribute between data signals, you may make it lost in a data signal, without collecting in this way and on the other hand, recording, and it may record, and with \*\*\*\* and the usual means which the above-mentioned separation reproduction becomes complicated in this case, since discernment of a data signal and an accident warning signal becomes difficult, security nature will be raised more.

[0036] Reproduction of a record signal distributes the above-mentioned accident warning signal, and if the case where made it lost in a data signal and it records is taken for an example, it will be performed by the procedure of the following \*\* - \*\*.

\*\* extraction [ of the re-reading \*\* data signal of the demagnetization \*\* signal record portion of the extraction \*\* signal record portion of the reading \*\* accident warning signal of a signal record portion ] \*\* -- previously -- reading -- a \*\*\*\*\* accident warning signal -- a data signal -- capable data -- conversion [0037] It is an outward trip at the time of the card insertion shown in this drawing (A), and drawing 3 processes the above-mentioned \*\* - \*\*, and it is what showed the reproduction dedicated device which has a read head 1 and the head 2 for demagnetization as the magnetic head, and it processes [ it is a return trip at the time of the card discharge shown in this drawing (B), and ] the above-mentioned \*\* - \*\*. In the above-mentioned \*\*, the magnetic card 3 which has a magnetic layer 31 on a substrate 30 is inserted in a reader, and a record signal is read by the read head 1. At this time, the head for demagnetization is in an OFF state. In the above-mentioned \*\*, since the data signal and the accident warning signal are contained in the reading signal of \*\*, these signals are separated and separation extraction only of the accident warning signal is carried out.

[0038] In the above-mentioned \*\*, the portion on which the signal was recorded is demagnetized with directions of the accident warning signal extracted by the above-mentioned \*\*. In that case, only a data signal may be demagnetized and both a data signal and an accident warning signal (i.e., all the signals that are memorized) may be demagnetized. In this demagnetization processing, with the card with which a line intermediary also contains MnBi magnetism powder in a magnetic layer, since the coercive force of MnBi magnetism powder is very large, a signal is not eliminated. On the other hand, all data will be eliminated with the card using the usual magnetic powder. Therefore, from the regular card using MnBi magnetism powder, by what copied data to the card using the usual magnetic powder, all the data of a copy card will be eliminated by the above-mentioned processing, and a reproduction error will be caused.

[0039] Re-reading of a signal record portion is performed in the above-mentioned \*\*. As for the card which contains MnBi

magnetism powder in a magnetic layer, a data signal and an accident warning signal are read again. It is performing this processing at the time of card discharge, and compared with reading of the usual card, there is also no un-arranging [ to which the processing time becomes late ], and the number of use heads can be lessened. In the above-mentioned \*\*, it reads by operation of the above-mentioned \*\*, and separation of a data signal is extracted from a \*\*\*\*\* signal. In the above-mentioned \*\*, since it is enciphered, the data signal extracted by the above-mentioned \*\* composite-izes the data signal which read previously and was therefore enciphered by the \*\*\*\*\* accident warning signal, and changes it into capable data.

[0040] It is what showed the example of the reproduction dedicated device which has two read heads 1A and 1B and heads 2 for demagnetization as the magnetic head unlike the equipment shown in above-mentioned drawing 3, and according to such equipment, drawing 4 is an outward trip at the time of card insertion, and can perform all processings from the above-mentioned \*\* to \*\*. Moreover, it is also possible to use the equipment which made the read head the double gap and was made into the gap for a lead and the gap for demagnetization without newly preparing the head for demagnetization other than these equipments.

[0041] Furthermore, although each above equipment shows the example of a reproduction dedicated device, it is also possible to consider as the reader writer which can also do the writing of a signal. In this case, it can respond by preparing write head in above-mentioned drawing 3 and the equipment of drawing 4 further, or using a read head as a read/write combination head.

[0042] Thus, since, as for the card of this invention, \*\*\*\*\* therefore is not eliminated at demagnetization processing but the card using the usual magnetic powder is altogether eliminated by the above-mentioned processing, all data will be eliminated and the counterfeit card which copied the data of the regular card containing MnBi magnetism powder causes a reading error.

Moreover, a data signal and an accident warning signal are separated, and even when only a data signal is copied without recording an accident warning signal including a demagnetization processing signal, since it is enciphered, this data signal cannot carry out [ \*\*\* ]-izing to capable data, unless it uses an accident warning signal. An accident warning signal is read, and data will be eliminated and it becomes impossible however, to reproduce \*\*\*\*\* and operation of demagnetization processing for a line intermediary \*\*\*\*\* reason. The copy prevention to the card which used the usual magnetic powder is effectively realizable by making MnBi magnetism powder contain this in a magnetic layer in this invention in short, and recording the accident warning signal for composite-izing demagnetization and the data signal of a signal record portion to capable data simultaneously with the data signal.

[0043] The magnetic-recording medium of this invention demonstrates especially power, when it applies to various kinds of ID cards, such as a credit card, a money card, and a close leaving card, so that clearly also from above-mentioned explanation. However, it cannot be overemphasized that it is applicable not only to these but various kinds of PURIPE-DOKA-DO, a magnetic commuter pass, a magnetic ticket, etc.

[0044] By the way, in order to usually spread a new record medium in a commercial scene, it is necessary to also newly develop the recording device and reader for using the medium first, and to spread these equipments. However, it is very difficult to already replace all of these equipments in the present condition that record and the reader have spread, like a magnetic card to all the corners in the world.

[0045] The magnetic-recording medium of this invention does not need special equipment for record of data, but can record it easily by using a general-purpose writer. And by reading of a signal, powerful security nature can be demonstrated by specification change of slight equipment that what is necessary is just to newly prepare the magnetic head for demagnetization. Therefore, this invention can offer a magnetic-recording medium with a very large merit from a practical standpoint.

[0046]

[Example] Hereafter, an example is given and explained about the magnetic-recording medium and its reproduction method of this invention. In addition, that it is in below with the section means the weight section.

[0047] Weighing capacity of Mn powder and Bi powder which were ground so that example 1 <composition of MnBi magnetism powder> grain size might become 200 meshes was carried out so that Mn and Bi might be set to 55:45 by the mole ratio, and it fully mixed using the ball mill. This mixture was cast by the pressure of 3t/cm with the pressurization press machine with a diameter [ of 20mm ], and a height of 10mm in the shape of a pillar. After putting this molding object into the aluminum container of a direct vent system and lengthening to a vacuum, 0.5 atmospheric pressure of nitrogen gas was introduced. This container was put into the electric furnace and it heat-treated for ten days at 270 degrees C. The MnBi ingot was taken out in air after this heat treatment, the mortar ground lightly, and magnetic properties were measured. Consequently, the coercive force which impressed and measured the magnetic field of maximum magnetic field 16kOe by 300k is 840Oe(s), and the amount of magnetization is 53.6 emu/g, and it is \*\*\*\*\*.

[0048] Next, the above-mentioned MnBi powder which carried out coarse grinding was pulverized as follows using the planet ball mill. The ball mill pot of 1,000 cc of content volume was filled up with JIRUKONIABO-RU with a diameter of 3mm so that one third of content volume might be occupied. Into this, toluene 500g was put in as the 500g of the above-mentioned MnBi powder which carried out coarse grinding, and a solvent, and it pulverized by rotational frequency 150rpm for 4 hours. Magnetic properties were measured, after taking out the obtained MnBi magnetism powder and evaporating toluene. Consequently, the coercive force which impressed and measured the magnetic field of maximum magnetic field 16kOe by 300k is 8,600Oe(s), and the amount of magnetization is 39.2 emu/g, and it is \*\*\*\*\*.

[0049] Subsequently, stabilizing treatment was performed to this MnBi magnetism powder by the following methods. MnBi magnetism powder was taken out in the state where it dipped in toluene, it moved to the heat treatment container, and the vacuum drying was carried out for about two weeks at the room temperature. To the next, putting into the same container, 1 atmospheric pressure of nitrogen gas containing 1,000 ppm of oxygen was introduced, and it was heat-treated at 40 degrees C for 15 hours.

Then, after having introduced 0.5 atmospheric pressure of nitrogen gas after carrying out vacuum length of the oxygen mixed gas with which the container is filled up and removing it as heat treatment of the 2nd phase, and raising temperature to 330 degrees C, it heat-treated at this temperature for 2 hours. The coercive force which a mean particle diameter is 1.8 micrometers, and the obtained MnBi magnetism powder impressed the magnetic field of maximum magnetic field 16kOe by 300k, and measured is 8,500Oe(s), and the amount of magnetization is 46.3 emu/g, and it is \*\*\*\*\*.

[0050] Mixed distribution of the MnBi magnetism powder (coercive force : 8,500 Oe) 100 section compounded by the <production of magnetic card> above-mentioned method, the vinyl-chloride-vinyl-acetate-copolymer ("VAGH" made from UCC) 25 section, the methyl-isobutyl-ketone 50 section, and the toluene 50 section was fully carried out with the ball mill, and the magnetic paint was prepared. This was applied on the base film with which the thickness in which the mold release layer was formed consists of a polyethylene terephthalate film which is 25 micrometers, and the longitudinal orientation magnetic field of 3,000Oe was impressed, it dried, and the magnetic layer whose thickness is 15 micrometers was formed. After having carried out temporary adhesion at the substrate with a thickness of 0.76mm made of vinyl chloride resin after carrying out the slit of this to width of face of 7.3mm and considering as a magnetic tape, and exfoliating a base film, carried out heating \*\*\*\*\*, the magnetic layer was made to lay underground into the above-mentioned substrate, and the magnetic card was produced.

[0051] The magnetic card was produced like the example 1 except having changed the example 2MnBi magnetism powder 100 section into the MnBi magnetism powder 85 section and the barium-ferrite magnetism powder (0.5 micrometer [ of average grain size ], coercive force 2,750Oe) 15 section.

[0052] The magnetic card was produced like the example 1 except having changed the example 3MnBi magnetism powder 100 section into the MnBi magnetism powder 70 section and the barium-ferrite magnetism powder (0.5 micrometer [ of average grain size ], coercive force 2,750Oe) 30 section.

[0053] The magnetic card was produced like the example 1 except having changed the example 4MnBi magnetism powder 100 section into the MnBi magnetism powder 85 section and the alpha hematite (alpha-Fe 2O3) powder 15 section.

[0054] The magnetic card was produced like the example 1 except having changed the example 5MnBi magnetism powder 100 section into the MnBi magnetism powder 70 section and the alpha hematite (alpha-Fe 2O3) powder 30 section.

[0055] The magnetic card was produced like the example 1 except having changed the example 6MnBi magnetism powder 100 section into the MnBi magnetism powder 85 section and the gamma-acid-ized ferromagnetism powder (0.4 micrometer [ of average grain size ], coercive force 300Oe) 15 section.

[0056] The magnetic card was produced like the example 1 except having changed the example of comparison 1MnBi magnetism powder 100 section into the barium-ferrite magnetism powder (0.5 micrometer [ of average grain size ], coercive force 2,750Oe) 100 section.

[0057] The magnetic card was produced like the example 1 except having changed the example of comparison 2MnBi magnetism powder 100 section into the gamma-acid-ized ferromagnetism powder (0.4 micrometer [ of average grain size ], coercive force 300Oe) 100 section.

[0058] About each magnetic card of the above-mentioned examples 1-6 and the examples 1 and 2 of comparison, record reproduction of a signal was performed and the performance was evaluated by the following method. These results are as being shown in the after-mentioned Table 1 and 2, and are \*\*\*\*\*.

[0059] Initialization processing of record of a signal and the <reproduction> magnetic card was carried out first. Record of a signal makes record current 200mA using a magnetic card reader writer ("CRS-700" by the Sanwa new tech company), and it was made for recording density to be set to 210FCI(s). Demagnetization processing is \*\*\*\*\* by passing a 200mA direct current to write head using the magnetic card reader writer as the above also with the same reproduction of a signal.

[0060] As a record signal, ten characters from Alphabet a to j were first recorded supposing the accident warning signal. Next, the capable data signal was set to 1, 2, ...., 19 and 20, A and B, ...., (S, T), and it recorded supposing the data signal which enciphered this alternately [ 20 characters ] from the numeric values from 1 to 20, and A to 1A, 2B, ...., (19S, 20T), and T of the alphabet. The flow of such processing of reproduction of record and after that is as follows.

[0061] (I) Reading of the [accident-warning-signal + data signal] by the record (II) read head of the [accident-warning-signal + data signal] (a, b, c, ...., i and j, 1A and 2B, ...., 19S, 20T) by write head () [ III ] as demagnetization processing of the signal by reading \*\*\*\*\* [an accident warning signal] (a, b, ...., i, j) -- write head -- a direct current -- passing -- a signal -- the signal after demagnetization (IV) demagnetization -- a read head -- re-reading -- [0062] In the above-mentioned record and the flow of reproductive processing, the result of reading processing (II) of a signal and the measurement result of the reproduction output of the magnetic card in this processing state were shown in the following table 1. Moreover, the result of re-reading processing (IV) of a signal and the measurement result of the reproduction output of the magnetic card in this processing state were similarly shown in the following table 2. In addition, the above-mentioned reproduction output is expressed with the rate (%) over the output at the time of record of the example 1 of comparison.

[0063]

表1

	(II) の状態での読み取り結果	
	読み取り内容	再生出力 (%)
実施例1	a, ...., j, 1, A, ...., 20, T	91
実施例2	a, ...., j, 1, A, ...., 20, T	93
実施例3	a, ...., j, 1, A, ...., 20, T	95
実施例4	a, ...., j, 1, A, ...., 20, T	80
実施例5	a, ...., j, 1, A, ...., 20, T	68
実施例6	a, ...., j, 1, A, ...., 20, T	98
比較例1	a, ...., j, 1, A, ...., 20, T	100
比較例2	a, ...., j, 1, A, ...., 20, T	115

[0064]

表2

	(IV) の状態での再読み取り結果	
	読み取り内容	再生出力 (%)
実施例1	a, ...., j, 1, A, ...., 20, T	85
実施例2	a, ...., j, 1, A, ...., 20, T	74
実施例3	a, ...., j, 1, A, ...., 20, T	62
実施例4	a, ...., j, 1, A, ...., 20, T	76
実施例5	a, ...., j, 1, A, ...., 20, T	65
実施例6	a, ...., j, 1, A, ...., 20, T	73
比較例1	エラー	0
比較例2	エラー	0

[0065] With the magnetic card of the examples 1-6 containing MnBi magnetism powder, from the result of the above-mentioned table 1 and Table 2 Also in the state of (IV) which is the 2nd re-reading processing after \*\*\*\*\* about demagnetization processing also in the state of (II) which is the 1st reading processing based on a reading \*\*\*\*\* accident warning signal (a, b, ...., i, j) It turns out that the accident warning signal (a, b, ...., i, j) and the data signal (1A, 2B, ..., 19S, 20T) are read normally.

[0066] on the other hand -- although the accident warning signal and the data signal are normally read in the state of (II) in the magnetic card of the examples 1 and 2 of comparison which do not contain MnBi magnetism powder -- demagnetization processing -- the state of (IV) after \*\*\*\*\* -- a reproduction output -- 0 and intermediary \*\*\*\* -- it turns out like that all signals will be eliminated and reading error is caused

[0067] When the data of the regular magnetic card which recorded the accident warning signal and the data signal using MnBi magnetism powder are copied to the usual magnetic card so that clearly from this result, since a signal will be eliminated, it will cause a reading error. moreover, when only a data signal is copied without recording the accident warning signal in which separation extraction is carried out and an accident warning signal and a data signal include a demagnetization processing signal, the contents of a reading signal are enciphered -- having had (1A, 2B, ...., 19S, 20T) -- it becomes this signal -- capable data -- it is (1, 2, ...., 19 and 20, A and B, ..., S, T) -- in order to change, it does not have an accident warning signal eye a required hatchet and that capable data will be known even if only a data signal is copied

[0068] In addition, in the magnetic card of the above-mentioned examples 1-6, the reproduction output shown in Table 1 and 2 can be adjusted to any value by adjusting the thickness of a magnetic layer, the addition rate of MnBi magnetism powder and other magnetic powder, etc.

[0069]

[Effect of the Invention] As mentioned above, this invention can prevent effectively the unauthorized use by copying data to the usual magnetic-recording medium which does not contain MnBi magnetism powder by recording the accident warning signal for performing demagnetization processing of the portion which recorded the data signal with the data signal in the magnetic-recording medium containing MnBi magnetism powder into the magnetic layer, and transform processing which changes a data signal into capable data.

[0070] Moreover, in order to spread a new medium in a commercial scene, it is necessary to also newly develop the recording device and reader for using the medium, and to spread these equipments. However, in the present condition that record and the reader have already spread to all the corners in the world like a magnetic card, it is in a very difficult situation to replace these equipments. According to this invention, not only powerful security nature but a recording device has a very large merit practically in order to end by slight change, though general-purpose equipment can be used as it is and a reader also changes change of signal-processing software and a hard portion.

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[Translation done.]